A longitudinal examination of dyadic distress patterns following a skills intervention for carers of adolescents with anorexia nervosa

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Abstract

Family interventions in anorexia nervosa (AN) have been developed to ameliorate maladaptive patterns of patient-carer interaction that can play a role in illness maintenance. The primary aim of this study is to examine the inter-relationship between baseline and post-treatment distress in dyads of carers and patients with AN in order to examine the interdependence between carers and patients. A secondary aim is to examine whether a carer skills intervention (Experienced Carer helping Others; ECHO) impacts on this inter-relationship. Dyads consisting of treatment-seeking adolescents (12-21 years) with AN and their primary carer (n=149; mostly mothers), were randomised to receive a carer skills intervention (ECHO) in addition to treatment as usual (TAU), or TAU alone, as part of a larger clinical trial. Carers and patients completed a standardised measure of psychological distress (The Depression, Anxiety, and Stress Scale) at baseline and 12-months post-treatment. The Actor Partner Interdependence Model was used to examine longitudinal changes in interdependence by treatment group. As expected, post-treatment levels of distress were related to baseline levels in both groups (actor effects). Moreover, carer distress at 12 months was related to patient distress at baseline for the TAU (partner effects), but not for the ECHO group. These findings are limited to predominantly mother-offspring dyads and may not generalise to other relationships. The ECHO intervention which is designed to teach carers skills in illness management and emotion regulation may be an effective addition to TAU for ameliorating interdependence of distress in patients and their primary carers over time.

Keywords: Anorexia Nervosa, Caregiving, Actor-Partner Interdependence Model (APIM), Longitudinal study, Distress, Clinical trial.

Introduction

Adolescent anorexia nervosa (AN) is a serious psychiatric disorder [1] characterized by high morbidity and mortality rates, and the prognosis is improved with early intervention [2]. The evidence base concerning treatment for adolescents with AN indicates that involving the family is a key factor [3]. Family based therapy has been studied most extensively [3]; it focuses on engaging the parents to manage the eating behaviour [4]. Most research using family based treatment has only measured patient outcomes and the impact on carers is unknown.

Caring for an individual with an eating disorder is burdensome [5] and is associated with distress and a reduction in quality of life [6]. The caregiving role can be "helpful" as exemplified in family based therapy but "less helpful vicious" circles of interaction can develop whereby high expressed emotion (criticism, hostility, and over protection) and the tendency to collude with the illness by accommodating to and/or enabling eating disorders symptoms serve to maintain the illness, as described in the cognitive interpersonal model [7, 8]. These less helpful forms of behaviours are often associated with high levels of distress and anxiety in both the patient and the parent [9]. Parent distress and burden can be reduced by interventions for parents, (as described in a systematic review [10]. However not all of these interventions have targeted these "less helpfulvicious" circles of interaction.

The carer skills intervention (Experienced Carer helping Others; ECHO) was specifically developed [11] to target the interpersonal relationship patterns developed in the cognitive interpersonal model. One facet of the model is based on the premise of emotional contagion within families whereby observing the emotional expressions of another person causes an automatic tendency to share the person's experiences [12]. Carers are therefore taught emotional regulation strategies so that they do not mirror the distress in their offspring (a potential "less helpful" interaction which escalates distress in the family). Carers are also taught how to reduce their own emotionally-driven behaviours such as overprotection and/or criticism and accommodation. There have, as yet, been no longitudinal studies that have examined whether this intervention does impact on the relationship between parent (or primary caregiver) and their offspring with AN.

Most studies about family involvement in the management of people with eating disorders have assessed changes in psychological distress of parents and/or patients. These approaches evaluate how the members of

the dyads (patients and parents) change individually, but they do not capture if and how the dyads' inter-relationship have changed. To date, no studies have examined changes in mutual interdependence. This study uses the Actor–Partner Interdependence Model (APIM) [13] as a method for identifying relational changes. The APIM is ideal for examining a relational phenomenon between two interdependent individuals because it treats the dyad (instead of the individual carer or patient) as the unit of analysis [14]. This model has been used to examine mutual collaboration or influence by modeling the impact of one dyad member's ratings on the other member's ratings (partner effects) while accounting for the interdependent nature of their relationship. Furthermore, it has been used in a variety of settings, including those where there is chronic illness in one family member, for example, spouses with chronic heart failure [15, 16], children with asthma [17], cystic fibrosis [18], and elderly parents [19].

The aim of this study was to examine the relationship over time between primary carer and eating disorder patient distress levels, and whether this interaction could be improved with the augmentation of the ECHO intervention. Moreover, patients' Body Mass Index (BMI) and duration of illness were included as important covariates in the APIM, according to research which had shown that these variables are related to the distress experienced by patients with eating disorders and their carers [10, 20].

Hypothesis 1: Actor effects. We hypothesized that carers' initial distress would be positively related to their distress at the end of treatment in both the two treatment conditions; and that patients' initial distress will be positively related to their distress at the end of treatment in both the two treatment conditions.

Hypothesis 2: Partner effects. We predicted that, in the treatment as usual (TAU) condition, patients' distress at baseline would predict carers' distress at time 1; whereas, for the carers given the ECHO intervention, no such relationship would be found, because one of the skills taught in the ECHO intervention was emotional regulation and a calm caregiving style; and therefore the partner effect would be ameliorated. Finally, we expected no association between the carers' distress and the patients' distress at time 1.

Methods

Design and Participants

This longitudinal study was a part of a multi-site randomized controlled trial examining the effect of a carer skills intervention (Experienced Carers Helping Others; ECHO) on the outcome of adolescents newly

referred for specialist outpatient treatment for AN (Trial registration: ISRCTN83003225) [21]. Thirty eight eating disorder outpatient services across the UK recruited patients (n=149) and up to three of their carers (n=226) for the study. Carers were identified as by the patient and needed to be currently living with the patient with the intention of living together for the following year. "Carers" are defined by criteria of the Princess Royal Trust (www.carers.org) as someone who provides unpaid help and support to a parent, child partner, relative, friend or neighbour. Carers also described themselves as primary or secondary. Definition of primary and secondary carer in the self-report questionnaire is referred to the level of dependence by the patient and number of hours of contact (i.e. primary carer might be the person who spends the most time with the patient or is the person who is called upon first; a secondary carer may be someone who is still very involved but maybe does not spend quite as much time with the patient or perhaps sees them less frequently).

The collaborating sites included 17 Child and Adolescent Mental Health Services (CAMHS), 13 Adult Mental Health Services and eight offering both CAMHS and Adult teams. All sites were managed within the National Health Service (NHS) and are listed in the acknowledgements section. Ethics approval was granted by the Northwick Park Hospitals Ethics Committee (11/H0725/4). Site specific ethics and governance approval was granted on all participating sites and this study adopted by the Clinical Research Network.

Consenting carers of patients aged 13-21 years with a primary diagnosis of AN or atypical AN, according to ICD-10 criteria [22] were randomly allocated to receive TAU or TAU in addition to ECHO. For the purposes of the present study, all patients randomized to the clinical trial and their primary carers only (*n* = 149 carer/patient dyads, typically mother/offspring dyads), were included in the analysis. Participants were grouped according to the type of treatment they received: 99 (66%) dyads received the ECHO intervention and 50 (34%) dyads received TAU alone.

Procedure

Following consent families were randomised to ECHO treatment or TAU. The ECHO materials and coaching were delivered from the research hub. There was no further interaction between the research hub and the contributing clinical sites where usual care was delivered. Follow up assessments included computerised self-report instruments and structured interviews for both carer and patients.

Intervention

Treatment as usual

The National Institute of Health and Clinical Excellence (NICE) guidelines have one grade B and several Grade C recommendations for the treatment of AN in adolescents and young adults [23]. Accordingly, most people with AN and atypical presentations should be managed on an outpatient basis with psychological treatment and physical monitoring provided by a health care professional competent to administer care and assess physical risk. NICE recommends this combination of treatment for at least six months duration, with more intensive forms of treatment to be considered in cases of significant deterioration, non-improvement or in cases of physical risk. Weight restoration in an outpatient setting should aim for an average weekly weight gain of 0.5 kg and for adolescents, family interventions that directly address the eating disorder should be offered (grade B). Furthermore, when treating adolescents, NICE guidelines endorse family involvement because of the effects of AN on other family members.

As would be expected for a pragmatic trial in EDs, TAU varied to some degree across the 38 collaborating sites included in the present study. However, TAU accessed by patients in the present study sample was comparable between the two treatment groups (TAU alone vs TAU+ECHO intervention) as would be expected as the patients were randomized by site and confirmed by finding no significant differences in tests of group comparison using Mann-Whitney U tests. During the 6-month period from ED outpatient referral, 80.59% of patients received some form of individual therapy (TAU=82%, ECHO=80%), 23.5% of the sample received family therapy (TAU=24%; ECHO=23%), and 33% received dietician counselling (TAU=22%; ECHO=38%). A further 44% of patients also reported visiting their General Practitioner during this time for reasons related to their ED (TAU=48%; ECHO=41%), 11% reported using self-help or telephone helplines (TAU=14%; ECHO=9%) and 34% of the patient sample also reported use of other services, such as the community psychiatric nurse, crisis intervention team, or occupational therapy (TAU=34%; ECHO=41%). During this 6-month period following outpatient referral, 21.5% of patients (TAU=18%; ECHO=23%,) were admitted to inpatient ED/general psychiatric services, 9% entered a daypatient ED programme (TAU=12%; ECHO=7%), and 15% accessed General Hospital (e.g. Emergency) services for medical reasons related to the ED (TAU=20%; ECHO=13%). Moreover, carers were asked about their use of services for individual reason(s) besides to accompany their relative (i.e. because of direct or indirect consequence of caring activities ED related). During the 6-month period from ED outpatient referral, 13.4% of carers reported visiting their General Practitioner during this time for individual reasons

ED related (TAU=16%; ECHO=12.1%), 10.1% reported using self-help or telephone helplines (TAU=10%; ECHO=10.1%) and 3.4% of the carers also reported use of other services, such as the community psychiatric nurse, group therapy, or dietician (TAU=2%; ECHO=4%).

Carer skills intervention (Experienced Carers Helping Others; ECHO).

This included a book [11] and DVDs. Moreover, 50.5% (n=50) of the ECHO sample (n=99) also received carer coaching (ECHOc). The content of the intervention has been summarised [24] and includes teaching carers emotional self-management, how to restrain their own emotionally driven behaviours (high expressed emotion, including emotional over-involvement, and accommodating and enabling behaviours) and communication skills (the basic principles of motivational interviewing.

Measures

Carers and patients provided standard demographic (age, ethnicity, marital/employment status, years in education) and clinical information (illness duration, diagnosis, height and weight) by self-report as part of the baseline assessment of the larger trial. Patient diagnosis and height and weight information were validated by clinicians at the treating site. Both Body Mass Index (BMI) and age standardised weight-for-height percentage, using Great Ormond Street Hospital for Children criteria, version 4.22 UK, were calculated for each patient. Furthermore, the AN-severity index (AN-TSI) of the Short Evaluation of Eating Disorders (SEED) [25] measure was used for the assessment of the severity of AN symptoms.

The Depression, Anxiety, and Stress Scale (DASS) [26] was used as an overall assessment measure of psychological distress in patients and carers at baseline (pre-treatment) and 12-month follow-up (post-treatment). The DASS is a 21-item measure assessing depression, anxiety, and stress over the past 7 days using a 4-point Likert Scale. The scores of these three subscales can be added to obtain a total score for psychological distress. Only the total score were considered in this study. This instrument has good psychometric qualities (Cronbach's alpha = .87 - .94) [27] and has good internal consistency in the present study (DASS at T0: Cronbach's = .94 and .94 for patients and carers, respectively; DASS at T1: Cronbach's = .96 and .95, for patients and carers, respectively).

Statistical Analyses

Data were acquired from questionnaires collected from both patients and carers at two time periods: T0 (baseline assessment, prior to treatment) and T1 (following one year of treatment). Descriptive statistics

(mean and standard deviations) were examined. Assumptions for parametric data were evaluated and no positive skewed distributions were found. Paired samples t-tests were conducted on patients and carers' DASS to examine differences between T0 and T1 assessments.

The APIM model tested in this study is displayed in Figure 1. Mplus software version 6.12 was used to test the model. Because the path model examined is identified (saturated) there is a perfect fit, so no model fitting statistics are showed. There are four variables in this longitudinal APIM model: two outcome variables (carers' and patients' distress at T1) and two independent (carers' and patients' distress at T0) that are expected to predict the outcome variables. Moreover, two additional patient variables (patients' BMI and duration of illness at T0) are also included in the model as independent variables. Carers' and patients' distress at T0 are based on the same measurement instruments as the outcome variables, but measured at an earlier point in time (baseline assessment, prior to treatment).

Using regression language to describe the relationships depicted in the figure there are four actor effects (a measure of a person's own characteristics predicts his or her outcome): (a) the effect of the carers' distress at T0 on their own distress at T1,(b) the effect of the patients' distress at T0 on their own distress at T1, (c) the effect of the patients' BMI at T0 on their own distress at T1 and (d) the effect of the patients' duration of illness at T0 on their own distress at T1 . Actor effects are represented in Figure 1 by the four paths labelled *a*. There are also four partner effects (a measure of interdependence, i.e. the extent to which a person's outcome is predicted by his or her partner's earlier characteristics): (a) the effect of the carers' distress at T0 on their children's distress at T1, (b) the effect of the patients' distress at T0 on their carers' distress at T1, (c) the effect of the patients' BMI at T0 on their carers' distress at T1 and (d) the effect of the patients' duration of illness at T0 on their carers' distress at T1. Partner effects are represented in Figure 1 by the paths labelled *b*. The APIM also models seven within dyad correlations (specified by the double-headed arrow in Figure 1): the relationships between carers' and patients' distress, BMI and duration of illness at T0 and the relationship between carers' and patients' Time 1 scores.

Results

Baseline Characteristics of Patient–carer Dyads

The clinical and socio-demographic characteristics of the patient group and their care givers are shown in Table 1. In the total sample, the patients were adolescents (average age 16.6 years) with a short duration of illness (22 months). The average BMI was 16.8 (age-adjusted weight-for-height 83%) and 75% fulfilled the criteria for ICD-10 AN and 25% for atypical AN (14% with restrictive food intake and 11% with binge eating and/or purging behaviors). The majority (93%) of the carers were mothers, of whom 74% were married and 30% were in full time employment. Other carers included fathers (5%), siblings (1%), and grandparent (1%).

Carer and Patient Distress at baseline and 12 months follow up

No differences were found between ECHO and ECHOc groups on BMI ($t = .031$, $p = .975$), duration of illness ($t = -.062$, $p = .951$) and levels of distress at baseline (for carers, ECHO: M (ds) = 34.62 (24.26), ECHOc: M (ds) = 34.50 (29.50), $t = .023$, $p = .981$; for patients, ECHO: M (ds) = 62.98 (29.35), ECHOc: M (ds) = 62.05 (32.56), $t = .386$, $p = .882$) and 12 months follow up (for carers, ECHO: M (ds) = 32.73 (26.85), ECHOc: M (ds) = 30.89 (22.28), $t = .331$, $p = .742$; for patients, ECHO: M (ds) = 51.85 (33.43), ECHOc: M (ds) = 47.51 (30.18), $t = .595$, $p = .554$), so in the current study we compared the ECHO (N=99) with the TAU condition (N=50).

The means and standard deviations for all of the variables examined in this study, separated for ECHO and TAU groups, are displayed in Table 2. The ECHO and TAU groups did not significantly differ on level of distress ($t = 1.83$, $p = .07$ and $t = -1.41$, $p = .16$, for patients and carers, respectively; data not shown in the table), BMI ($t = .481$, $p = .63$) and duration of illness ($t = .159$, $p = .87$) at baseline. Patients had high levels of distress at baseline (mean 67 (30)) and carers had low levels (mean 32 (28)). Patients' distress decreased over time to moderate levels in both the ECHO ($t = 3.659$ ($df = 76$), $p < .001$, ES = 0.38) and TAU ($t = 3.381$ ($df = 31$), $p < .01$, ES = 0.62) groups.

Carers in the ECHO group had a small decrease (ES = 0.12) in DASS scores at T0 whereas in the TAU group there was a small increase (ES = -0.13) in DASS.

Actor–Partner Interdependence Model (APIM) Analyses

Actor Effects

The results of APIM approach are displayed in Table 3. For the TAU group, patient and carer's distress, patients' BMI and duration of illness at baseline accounted for 41% and 24% of the variance in carer and

patient's distress at T1, respectively. For the TAU group, there were significant actor effects for both patients and carers. Specifically, carers' distress at baseline was a significant predictor of their own distress at Time 1 (β = .49, p < .001) and patients' distress at Time 0 was a significant predictor of their own distress at Time 1 (β = .48, p < .01). Neither patients' BMI nor duration of illness were significant predictors of their own distress at Time 1 (β = .11, p = .521 and β = -.09, p = .542, respectively)

For the ECHO group patient and carer's distress, BMI and duration of illness at baseline accounted for 23% and 31% of the variance in carer and patient's distress at T1, respectively . For the ECHO group, there were significant actor effects for both patients and carers. Specifically, carers' distress at baseline was a significant predictor of their own distress at Time 1 (β = .42, p = <.001) and patient's distress at Time 0 was a significant predictor of their own distress at Time 1 (β = .47, p < .001). Moreover, duration of illness was a nearly significant predictor of patients' distress at Time 1 (β = -.18, p = .051), whereas no relationship was found between patients' BMI and their own distress at Time 1 (β = .13, p = .197).

Partner Effects

The results of partner effects from APIM approach are displayed in Table 3. In the TAU group there was a significant partner effect between patient's distress at baseline and carer's distress at Time 1 (β = .29, p < .05). Neither patients' BMI nor duration of illness was significant predictor of carers' distress at Time 1. In the ECHO group there were no partner effects for carers and patients.

Discussion

The aim of this study was to examine the relationship over time between the primary caregiver's (typically mother) distress and that of the person with AN for whom they care (typically offspring). A secondary aim was to examine whether this interaction could be improved (i.e. reduce distress inter-dependence) with treatment augmented with ECHO. Both the carers and patients actor effect hypotheses were supported, in that we found that carers' initial distress was positively related to their distress at the end of treatment in both of the two treatment conditions; and patients' initial distress was positively related to their distress at the end of treatment in both of the two treatment conditions. These findings are consistent with previous studies which showed that higher level of symptomatic distress at baseline predict a worse outcome for AN patients [28] and family carers as well [10]. We also confirmed our second hypothesis in that we found that carers

who received the ECHO treatment were less impacted by patients' initial levels of distress (i.e. no partner effects were found), whereas there were partner effects for the TAU group, as carers' levels of distress at one year were related to the patient's initial level of distress. This suggests that the ECHO intervention, delivered in addition to TAU, might be effective in ameliorating interdependence of distress over time. These findings are in line with previous evidence of interdependence between family members in chronic illness. For example, in a study of families with elderly relatives a partner effect was found whereby caregiver's spirituality significantly influenced the elder's psychological well-being [19]. However patients with chronic heart failure had poorer quality of life if their spouses had more depressive symptoms and higher anxiety [15]. Conversely better heart failure self-care was associated with better quality of life for their spouses [16]. The caregiving demands of a child with asthma had an impact on the perception of family adaptation by both parents [17]. However, to our knowledge this has been the first study which has examined the impact of an intervention targeting caregiving behaviours on these partner effects. It is of note that the majority of studies in the literature regarding the efficacy of family-based treatment with adolescent AN patients have only focused on the patient's outcome, without reporting data relating to the carers [20, 29]. Thus we have very little evidence about the influence of the patient's distress on carer's outcome. Moreover, no previous study on the efficacy of family-based treatment modeled couple-related data. The findings of the current study are promising and seem to support the complex interactions between AN patients and carers which are described in the cognitive-interpersonal maintenance model of AN [8], but further evidence is needed on how interpersonal relationships become entangled with the eating disorder and what therapeutic strategy can be effective in reducing dysfunctional relationship patterns.

The strengths of the study described in this paper include the use of a sample with high external validity and the use of the APIM model, which is specifically designed to test associations between correlated constructs from two members of a dyad. Despite such strengths, various limitations must be considered when interpreting the results of this study. We have only considered the interaction effect between the primary carer (predominantly mothers) and patient (typically offspring). Although up to three carers were invited to participate in the overall clinical trial, including fathers for 47% of patients, there were insufficient data to analyse other dyadic relationships. However, it would also be interesting to examine partner effects for fathers as anecdotally they can have an important impact. Furthermore, the patients included in this present

study predominantly have a short illness course and a mild to moderate severity. Therefore these findings may be limited in the extent to which they can be generalized to more severe and chronic AN family dyads. Moreover, as inclusion criteria for the larger clinical trial required at least one carer to also participate, the present sample might be biased towards a sample with parents and other carers more actively involved in their care. Finally, the measure of baseline and post-treatment distress is a short 21-items screening tool with a Likert scale and a global evaluation of distress is considered for this study. Limitation of Likert scale are well known and future studies should use different diagnostic measures to deeper understand which specific aspects of patients' and carers' distress are more affected by the ECHO intervention.

Clinical implications

These partner effects on distress suggest that the emotional regulation skills taught in the ECHO intervention had a beneficial effect in terms of breaking the unhelpful cycle of maintenance in which carers mirror the distress in their affected relative, which in turn leads to more distress in the patient, and other maladaptive caregiver responses (e.g. high levels of expressed emotion). These results validate the cognitive interpersonal maintenance model of AN as it suggests that a specific intervention targeting one of the maintaining factors can reduce carer distress [8]. Other family interventions that share skills in emotion regulation within an interpersonal context may also provide similar benefit.

Conclusion

Our findings suggest that Actor–Partner Interdependence Model of Analyses can be a useful method of examining the processes involved in family interventions. In the TAU group we found interdependence of distress between patients and primary carers (mostly mothers) over time. However, this mutual influence was not seen in the ECHO group. This suggests that skills taught in the ECHO intervention were having a positive effect in terms of breaking a positive feedback effect whereby carers mirror the distress in their offspring which in turn leads to more distress in the patient, as theorized in the interpersonal component of the cognitive interpersonal maintenance model of AN.

Table 1. Demographic and clinical characteristics of the sample.

	ECHO group (n = 99)	TAU group (n = 50)
	Mean (SD)/N (%)	Mean (SD)/N(%)
Patient		
Age	16.90 (2.17)	16.86 (2.06)
Female : Male	89 (90): 10 (10)	48 (96): 2 (4)
Ethnicity		
White British/Other White	93 (94)	47 (94)
Asian/Asian British/Other Asian	2 (2)	3 (6)
Mixed White and Black African/Caribbean	3 (3)	0
Missing	1 (1)	0
BMI on admission (kg/m²)	16.78 (2.33)	16.97 (2.03)
Weight for Height %	82.23 (11.88)	84.10 (10.16)
Primary diagnosis		
Anorexia nervosa	71 (72)	41 (82)
Atypical anorexia nervosa	28 (28)	9 (18)
Severity of AN symptoms (SEED AN-TSI)	1.85 (.61)	1.90 (.55)
Illness duration (months)	22.14 (22.39)	22.76 (22.57)
Primary Carers		
Age	48.17 (5.78)	48.52 (4.92)
Female : Male	92 (93): 7 (7)	50 (100): 0 (0)
Carer type		
Mother	90 (91)	49 (98)
Father	7 (7)	0
Grandmother	1 (1)	0
Sibling	1 (1)	1
# years in education	15.18 (2.71)	15.98 (5.03)
Employment status		
Full time	34 (34)	13 (26)
Part time	35 (35)	24 (48)
Unemployed / retired / sick leave / student	22 (22)	10 (20)
Other	8 (8)	3 (6)
Ethnicity		
White British/Other White	94 (94)	47 (94)
Asian/Asian British/Other Asian	2 (2)	1 (2)
Other ethnic group	0	1 (2)
Missing	3 (3)	1 (2)
Marital status		
Married / living together	72 (73)	38 (76)
Single/divorced /separated/widowed	27 (27)	12 (24)

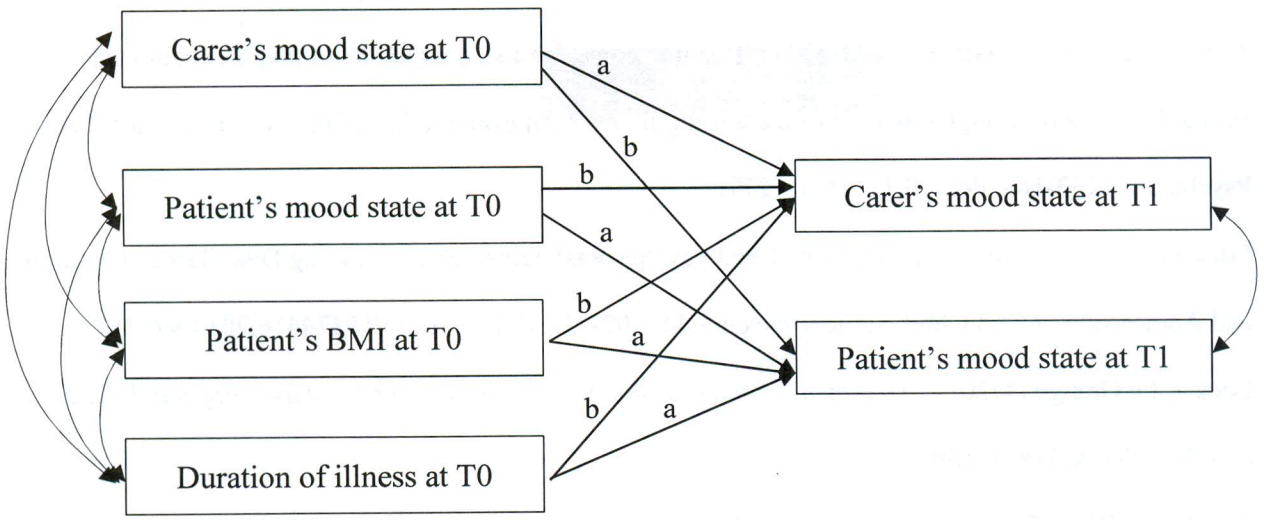
Table 2. Carer and patient distress (DASS) at baseline (Time 0) and one year follow up (Time 1) in the ECHO and TAU groups).

	Time 0 M (SD)	Time 1 M (SD)	t	*p*	*d.*
ECHO group (n = 99)					
Carer distress	34.56 (26.90)	31.84 (24.62)	.784	.435	0.12
Patient distress	62.50 (30.88)	49.82 (31.82)	3.659	.000	0.38
TAU group (n = 50)					
Carer distress	29.28 (18.10)	32.46 (29.01)	-.589	.559	-0.13
Patient distress	72.20 (29.00)	52.92 (32.67)	3.381	.002	0.62

Table 3. APIM analysis carer' and patients' distress at baseline (Time 0) and 1 year follow-up (Time 1) by treatment group.

APIM parameters	*ECHO group*				*TAU group*			
	b (β)	*SE*	*t*	*p*	*b (β)*	*SE*	*t*	*p*
Actor effects								
Carer distress T0 Carer distress T1	.391 (.423)	.099	4.278	.000	.777 (.493)	.116	4.258	.000
Patient distress T0 Patient distress T1	.486 (.471)	.090	5.222	.000	.550 (.481)	.147	3.262	.001
Patient BMI T0 Patient distress T1	1.741 (.127)	.099	1.289	.197	1.759 (.108)	.168	.641	.521
Duration of illness T0 Patient distress T1	-.256 (-.180)	.092	-1.954	.051	-.134 (-.091)	.150	-.610	.542
Partner effects								
Carer distress T0 Patient distress T1	.200 (.169)	.096	1.748	.080	.082 (.045)	.159	.282	.778
Patient distress T0 Carer distress T1	.127 (.157)	.103	1.523	.128	.281 (.285)	.124	2.301	.021
Patient BMI T0 Carer distress T1	-.724 (-.068)	.103	-.658	.510	2.788 (.199)	.120	1.659	.097
Duration of illness T0 Carer distress T1	-.077 (-.069)	.104	-.667	.505	-.104 (-.082)	.135	-.608	.543

Figure 1. Diagram of the actor partner interdependence model (APIM) for carers' and patients' mood state at baseline and follow-up and patients's BMI and duration of illness at baseline.



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